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(54) ELECTRICAL CONNECTOR ARRANGEMENT

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(57) Claim

1. An electrical connector member comprising a connector shell having a forward mating end, a ring fixedly mounted concentrically on said shell adjacent to said forward mating end, said ring being formed of a material different than that of said shell, and said ring embodying a surface engageable by a mating connector member.

7. An electrical connector comprising mating first and second connector members each having a shell, a ring fixedly mounted on said one connector member shell, said ring being formed of a material having physical properties different from that of said one connector member shell, and said ring and said second connector member having cooperating surfaces which engage each other when said first and second connector members are mated.

ORIGINAL

40728/85

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952-1969

COMPLETE SPECIFICATION FOR THE INVENTION ENTITLED

"AN ELECTRICAL CORRECTOR ARRANGEMENT"

The following statement is a full description of this invention, including the best method of performing it known to us:-

The present invention relates generally to an electrical connector and, more particularly, to a novel construction of the receptacle shell of a connector.

It is common practice in the connector industry to manufacture the receptacle shell and plug barrel of an electrical connector of a relatively soft and lightweight material, such as aluminium or bronze. For self-locking connectors, it is also desirable to provide ratcheting teeth on the forward mating end of the receptacle shell, which are engageable by a locking ring carried by the coupling nut which is rotatably mounted on the plug barrel. Also, it is common practice to provide polarizing keyways on the inner periphery of the receptacle shell which are engaged by matching keys formed on the plug barrel. The cost of fabricating ratchet teeth and keyways in a one-piece connector shell is relatively high. Because of the soft material of the aforementioned receptacle shells, the ratchet teeth would wear relatively rapidly if a wear resistant protective layer were not provided for the shell. Thus, it is necessary to electroplate or otherwise provide a wear resistant protective layer on the surface of the shell to minimize the wear of the ratchet teeth. Such a plating process adds to the cost of manufacture of the connector. Also, it is possible that the plating may become chipped or wear after a number of couplings and uncouplings of the connector.

It is therefore an object of the present invention to provide an improved construction of the receptacle shell of an electrical connector embodying ratchet teeth, polarizing keyways or similar complex shaped surfaces, which may be manufactured at lower cost and will avoid the wear and plating chipping problems associated with present connectors utilizing soft material shells or plated shells, respectively.

Accordingly, there is provided an electrical connector member comprising a connector shell having a forward mating end, a ring fixedly mounted concentrically on said shell adjacent to said forward mating end, said ring being formed of a material different than that of said shell, and said ring embodying a surface engageable by a mating connector member.

The connector shell described below has a separate nose ring fixedly mounted concentrically adjacent to the forward mating end of the shell. The ring embodies a surface which is engageable by a mating connector member. For example, the nose ring may embody ratchet teeth which are engageable by a locking ring carried by the coupling nut on the mating connector member, or keyways which are engaged by keys formed on the shell of the mating connector member. The nose ring is formed of a material which is different than that of the shell upon which it is mounted. For example, the ring may be formed of a material which is harder than the material of the shell. The cost of

forming the ratchet teeth and keyways on a separate narrow ring is less than that for manufacturing such shapes on a connector shell. Furthermore, by the use of a hard ring embodying ratchet teeth, the need for electroplating or otherwise protecting the engaging surface of the shell is eliminated, thereby further reducing manufacturing costs. In addition, by eliminating the electroplating layer, plating chipping is also eliminated, thus providing a connector which has a longer useful life.

In order that the invention may be readily carried into effect it will now be described in detail by way of example with reference to the accompanying drawings in which:

Fig. 1 is a fragmentary, partial longitudinal sectional view of a fully mated electrical connector embodying the novel receptacle shell construction of the present invention utilizing a separate nose ring;

Fig. 2 is an elevational view of the locking ring utilized in the connector illustrated in Fig. 1;

Fig. 3 is an enlarged fragmentary sectional view showing how the nose ring is mounted on the forward mating end of the receptacle shell;

Fig. 4 is a partial longitudinal sectional view through the nose ring;

Fig. 5 is a front end view of the nose ring;

Fig. 6 is an enlarged fragmentary sectional view similar to Fig. 3 showing an alternate form of a nose ring which may be mounted on the forward end of a receptacle shell; and

Fig. 7 is a longitudinal sectional view through the nose ring of the type utilized in the embodiment illustrated in Fig. 6.

Referring now to the drawings in detail, there is illustrated in Figs. 1 to 5 an electrical connector embodying one form of the nose ring of the present invention.

Referring to Figs. 1 and 2, the connector 10 comprises a plug 12 and a mating receptacle 14 which are shown in their fully mated condition. The plug comprises a barrel 16 surrounding an insulator insert assembly 18 containing a plurality of socket contacts 20, only one being shown. The receptacle 14 comprises a shell 22 surrounding an insulator insert assembly 24 containing a plurality of pin contacts 26 each adapted to mate with a corresponding socket contact 20 when the plug and receptacle are interengaged. The receptacle is shown as being mounted on a mounting plate 30 by a jam nut 32.

A coupling ring 34 is rotatably mounted on the plug barrel 16, and is held against axial movement on the barrel by a retaining ring 36. The coupling ring is preferably in the form of a conventional coupling nut having screw threads 38 on its internal surface adapted to engage with matching screw threads 40 on the exterior surface of the forward end of the shell 22.

Polarizing keys 42, only one being shown, are formed on the exterior surface of the forward end of the barrel 16. The keys are adapted to slide in matching longitudinally extending keyways 44 formed in the interior surface of the forward end of the shell 22.

A separate, narrow nose ring 45 is provided which is fixedly mounted in a concentric relationship to the shell 22 in an annular recess 46 formed in the forward mating end of the shell. The nose ring is formed of a material different than that of the shell 22. For example, the shell may be formed of a relatively soft, lightweight material such as aluminium or bronze, which is easily machined, and is relatively inexpensive, while the nose ring may be formed of a harder material. such as stainless steel. The nose ring is formed on its outer periphery with ratchet teeth 47. Preferably the ring is dimensioned axially so that its forward end 48 will bottom out against a forwardly facing shoulder 49 on the barrel 16 when the connector members 12 and 14 are fully mated to provide RFI protection.

A locking ring 52, which can best be seen in Fig. 2, is carried by the coupling nut 34. The locking ring is mounted in an annular groove 54 formed in the interior surface of the coupling nut behind the screw threads 38 thereon. When the connector members are fully mated, the locking ring 52 is axially aligned with the rear portion of the nose ring 45 as seen in Fig. 1.

Referring again to Fig. 2, the locking ring comprises a resilient split ring 58 providing a gap 60 between the two free ends of the ring. Radially inwardly extending resilient projections 62 are formed on the ring, preferably by inwardly bent portions of the ring. The depth of the groove 54 is such that when the locking ring 52 is mounted in the groove, the projections will extend radially inwardly from the interior surface of the coupling nut into grooves 56 formed between the ratchet teeth 47 on the nose ring 45.

The forward portions66 of the ratchet teeth slant inwardly toward the leading edge 48 of the nose ring 45.

During initial mating of the plug with the receptacle, the coupling nut 34 is rotated in the clockwise direction, as viewed from the rear of the plug, causing the threads 38 and 40 to interengage thereby pulling the plug barrel 16 forwardly so that the contacts 20 and 26 will mate. During initial rotation of the coupling nut, the locking ring 52 is remote from the threads on the receptacle shell so that it does not impose any restriction to mating of the connector members. During the last turn of the coupling nut, the projections 62 on the locking ring will ride up over the inclined surfaces 66 on the ratchet teeth under relatively low force. During this period, the bent end projection 62 will deform radially outwardly causing the gap 60 between the free end of the spring 62 to shorten slightly. After the locking ring passes over the top

of the inclined surfaces 66, the projections 62 will snap into the grooves 56 on the ring 45 providing a tactile indication of complete locking and, hence, mating of the connector assembly. In order to unlock and uncouple the connector 10, the coupling nut 34 is rotated in a counterclockwise direction with a high torque to force the projections 62 of the locking ring out of the grooves 56.

While the nose ring 45 has been disclosed as having ratchet teeth formed on its outer periphery, the ring could be formed with an annular groove adjacent to the rear edge of the ring, and with a sloping circumferentially continuous ramp corresponding to the inclined surfaces on the ratchet teeth 66, such as embodied in the forward end of the receptacle connector shell. Other forms of ratchet teeth or complex locking shapes could also be utilized on the nose ring 45.

The nose ring may be fixed to the forward end of the receptacle shell by any of many conventional fabrication techniques including shrink fitting, press fitting, welding, adhesives, etc.

An alternative form of the nose ring of the invention, generally designated 45', is illustrated in Figs. 6 and 7. In this embodiment, the nose ring is formed on its outer periphery with ratchet teeth 56' similar to the ratchet teeth 56 on the nose ring 45. In addition, the nose ring 45' is formed with polarizing keyways 44' in its inner surface which are engageable by matching keys formed on the outer surface of the plug barrel, not shown. The rear portion 70 of the nose ring 45' fits within an annular recess 72 formed in the inner surface of the receptacle shell 22'. The ring 45' may be fixedly mounted on the forward end of the shell 22' by any of the techniques disclosed above in connection with the mounting of the nose ring 45 on the shell 22 in the first embodiment of the invention.

Thus, the present invention provides a complex shaped nose ring which is fixedly mounted on the forward end of a connector shell. The ring is formed of a material different than that of the shell, and typically of a harder material so that it will not be subject to wear when engaged by surfaces on the mating connector member, such as locking elements, polarizing keys or the like. The nose ring of the present invention avoids the necessity of providing a special wear resistant protective coating, such as typically provided by electroplating on the receptacle shell. Furthermore, the cost of machining or otherwise forming complex shapes on the narrow nose ring is less than that required for forming the same shapes on a standard connector shell. Thus, the connector member of the present invention is less expensive to manufacture than conventional connectors having complex shapes on the forward ends of the shells, electroplating is not required, and wear of the engaging polarizing and

locking parts, for example, is substantially reduced.

The claims defining the invention are as follows:

1. An electrical connector member comprising a connector shell having a forward mating end, a ring fixedly mounted concentrically on said shell adjacent to said forward mating end, said ring being formed of a material different than that of said shell, and said ring embodying a surface engageable by a mating connector member.

2. An electrical connector member as claimed in claim 1, wherein said shell is formed of metal, and said ring is formed of a metal harder than that of said shell.

3. An electrical connector member as claimed in claim 1 or 2, wherein said surface of said ring is a complex shaped surface.

4. An electrical connector member as claimed in claim 3, wherein said shaped surface comprises a plurality of ratchet teeth.

5. An electrical connector member as claimed in claim 3, wherein said shaped surface comprises a plurality of polarizing keyways.

6. An electrical connector member as set forth in claim 1, wherein said ring has exposed inner and outer peripheries, ratchet teeth being formed on said outer periphery, and polarizing keyways being formed on said inner periphery.

7. An electrical connector comprising mating first and second connector members each having a shell, a ring fixedly mounted on said one connector member shell, said ring being formed of a material having physical properties different from that of said one connector member shell, and said ring and said second connector member having cooperating surfaces which engage each other when said first and second connector members are mated.

8. An electrical connector as set forth in claim 10, wherein said cooperating surface of said ring comprises ratchet teeth formed on the outer periphery of said ring, and said cooperating surface of said second connector member is provided by a locking ring carried by a coupling nut rotatably mounted on said second connector member shell.

9. An electrical connector as claimed in claim 7, wherein said cooperating surfaces are provided by polarizing keyways and keys on said ring and said second connector member shell.

10. An electrical connector as claimed in claim 8, wherein said second connector member shell is slidable within said first connector member shell, and said cooperating surfaces also include polarizing keyways and keys on the inner periphery of said ring and on the outer periphery of said second connector member shell, respectively.

11. An electrical connector as set forth in claim 10, wherein said ring is formed of a material harder than that of said one connector member shell.

12. An electrical connector substantially as herein described with reference to Figs. 1-7 of the accompanying drawings.

DATED THIS TWENTY-EIGHTH DAY OF MARCH 1985

ITT CORPORATION

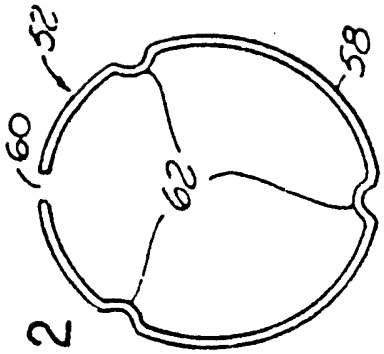
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FIG. 2

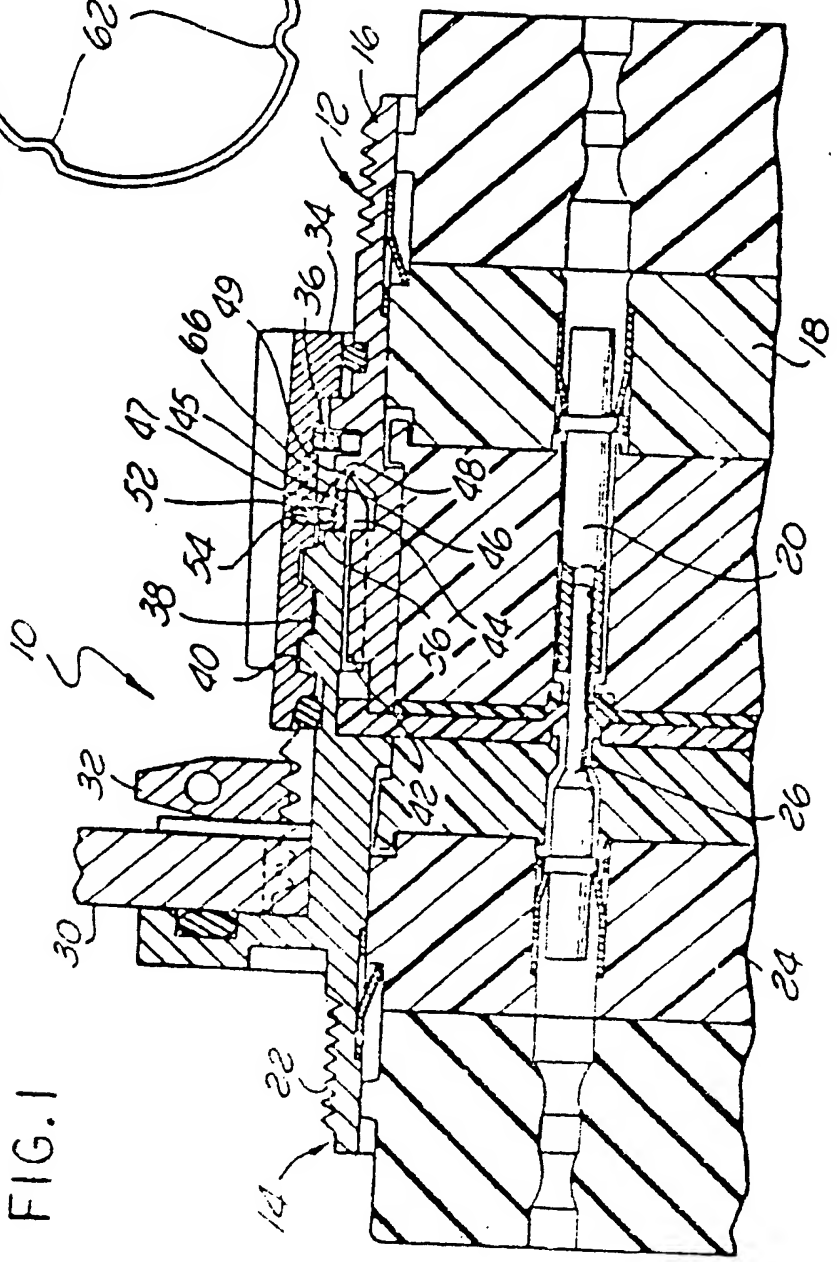
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FIG. 1